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ABSTRACT

This guide is designed to be another segment of the total educational program established by state administration and mandated by the Louisiana Legislature in both the accountability and assessment and the competency-based education laws. This document outlines a course of instruction based on thirty weeks of school, which provides six weeks of instruction as "pad" time in allowing for other factors that affect pacing. There are two major parts to the guide. The first section provides a curriculum outline and performance objectives, with all items mandatory unless preceded by an asterisk. Part two outlines sample activities designed to teach the listed content and meet student objectives. The document concludes with a limited bibliography. (MP)

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GEOMETRY

CURRICULUM GUIDE

Louisiana State Department of Education

J. Kelly Nix

State Superintendent

SE 034 916

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STATE OF LOUISIANA

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GEOMETRY CURRICULUM GUIDE

Issued by

Division of Academic Program

J. KELLY NIX
State Superintendent

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FOREWORD

Curriculum guides have been developed for each mathematics course at the secondary level and for grades K-8 at the elementary level. These guides represent the best thinking of a selected statewide committee established to determine the scope of mathematics content which should be taught at each level.

The mathematics curriculum guides are another segment of the total educational program established by this administration and mandated by the Legislature in both the accountability and assessment and the competency-based education laws. This educational program requires that specific skills and concepts be established for each grade level and for each subject area. The mathematics curriculum guides with course outlines, performance objectives and coordinated activities effect this phase of the program.

It is hoped that the guides will make a major contribution to the improvement of mathematics instruction in the schools of Louisiana. This is another step toward achieving the goals of this administration.

FOR OUR CHILDREN

J. KELLY NIX

ACKNOWLEDGMENTS

The statewide mathematics committee is to be commended for its work in the development of the Mathematics Curriculum Guides K-12. The committee worked under the chairmanship of Dr. Jean Reddy, Section Chief of the Mathematics Section in the Bureau of Secondary Education.

The Bureaus of Elementary Education and Secondary Education were responsible for writing the activities component of the Mathematics Curriculum Guides. The elementary supervisors in the Bureau of Elementary Education with Mrs. Bonnie Ross serving as chairman of the committee, developed the activities for the K-8 guide. The activities for the secondary guides were drafted by a committee under the leadership of Dr. Jean Reddy. These people are to be commended for their colossal accomplishments in this formidable project.

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INTRODUCTION

Act 750 of the 1979 Louisiana Legislature established the Louisiana Competency-Based Education Program. One of the most important provisions of Act 750 is the mandated "development and establishment of statewide curriculum standards for required subjects for the public elementary and secondary schools of this state...." The "statewide curriculum standards for required subjects" is defined as "the required subjects to be taught, curriculum guides which contain mimimum skills and competencies, suggested activities, suggested materials of instruction, and minimum required time allotments for instruction in all subjects." Act 750 further provides that the "effective implementation date of the statewide curriculum standards for required subjects shall be the 1981-82 school year. Development of such curriculum shall begin by the 1979-80 school year."

During the 1978-79 school year, curriculum guides were developed by advisory and writing committees representing all levels of professional education and all geographic areas across the State of Louisiana for the following mathematics courses:

> Algebra I, Algebra II, Geometry, Advanced Mathematics, and Trigonometry.

The major thrust of the curriculum development process in each of the guides has been the establishment of minimum standards for student achievement. Learning expectancies for mastery have been determined for each course and/or grade level. In addition, content outlines, suggested activities, procedures, and bibliographies have been developed as aids in support of the learning expectancies. The curriculum guides also contain activities designed to stimulate learning for those students capable of progressing beyond the minimums.

During the 1979-80 school year, the curriculum guides were piloted by teachers in school systems representing the different geographic areas of the state as well as urban, suburban, inner-city, and rural schools. The standard populations involved in the piloting reflected also the ethnic composition of Louisiana's student population. Participants involved in the piloting studies utilized the curriculum guides to determine the effectiveness of the materials that were developed. Based upon the participants' recommendations at the close of the 1979-80 pilot study, revisions were made in the curriculum guides to ensure that they are usable, appropriate, accurate, comprehensive, relevant, and clear.

The curriculum guides are now ready for full program implementation. This stage must be understood in its operational context. The curriculum developers and the participants in the pilot studies do not stand alone in promoting learning expectancies that will improve education for the students in the State of Louisiana. Ultimately, local system supervisors, principals, and classroom teachers will have the responsibility for attaining this goal.

As curriculum guides are implemented, the following guidelines should prove helpful:

> ...curriculum standards should be considered as the foundation for the year's instructional program. Where other programs are already in operation, these curricular materials must be checked with the foundation curricula to ensure that appropriate course and/or grade level standards are included and maintained.

...curricular activities contained in the guides provide a number of suggestions for helping students to achieve the established standards. Activities to meet the needs of "average," "below average," and "above average" students have been included. These activities should prove helpful as the teacher plans and organizes instruction. Additional activities, however, may supplement or be used in lieu of those listed in the guide as long as these activities are designed to achieve similar specific objectives.

...curricular suggestions for meeting the needs of the special child have been prepared by the Division of Special Education. These suggestions are designed to provide help for teachers who work with special children in the regular classroom.

The continued effort of mathematics teachers to provide quality instruction will enhance our statewide goal to ensure that every student in the public elementary and secondary schools of the State of Louisiana has an opportunity to attain and to maintain skills that are considered essential to functioning effectively in society.

J. KELLY NIX
State Superintendent of Education

GOALS

Upon completion of the secondary course in geometry, a student will be able to:

1. Understand structure in mathematics and what constitutes deductive reasoning.

2. Prove theorems in geometry.

3. Master the concepts of parallelism and perpendicularity and apply these concepts in the solution of problems.

4. Comprehend the concepts of congruence and similarity and apply these concepts in the solutions of problems.

5. Acquire a basic knowledge and understanding of the properties of circles and circular regions.

6. Find the perimeter and area of selected polygons and polygonal regions.

7. Use a straight edge and compass to construct figures satisfying stated conditions.

8. Acquire a basic knowledge of analytic geometry.

PACING CHART

The following pacing chart contains suggested periods of time to devote to each major topic in the mandatory portion of this Geometry Curriculum Guide. Since students learn at different rates and since days are lost during the school year for various reasons, this pacing chart is based on approximately 30 weeks of school. This provides six weeks of school to utilize as "pad" time in allowing for the factors affecting pacing. Should students complete the mandatory material prior to the end of school, this guide provides ample optional and supplemental material to use as enrichment.

	TOPIC	NUMBER OF DAYS
I.	Introduction	5
II.	Real Numbers	4
III.	Distance	4
IV.	Lines and Planes	2
V.	Angles and Triangles	6
VI.	Parallel Lines	13
VII.	Congruent Triangles	30
VIII.	Methods of Reasoning	13
IX.	Triangles and Inequalities	15
X.	Similar Triangles	15
XI.	Area	15
XII.	Circles	10
XIII.	Construction	5
XIV.	Circular and Polygonal Regions	10
XV.	Volume	(Time Permitting)
XVI.	Coordinate Geometry	(Time Permitting)

CURRICULUM OUTLINE AND PERFORMANCE OBJECTIVES

NOTE: All items are mandatory unless preceded by an asterisk. All items with an asterisk should be taught if time permits (See Pacing Chart).

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
I. Introduction to Geometry	To demonstrate a basic understanding of structure in geometry, the student will be able to:
A. Undefined terms	A. Identify the undefined terms that are used in geometry.
B. Basic postulates	B. Identify and use the basic postulates of geometry.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
II. Real Numbers	To demonstrate an understanding of the real number system, the student will be able to:
A. Order properties	A. Name, recognize, and use the order properties of the real numbers.
B. Absolute value	B. Find the absolute value of real numbers.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
III. Distance	To demonstrate an understanding of distance concepts, the student will be able to:
A. Distance concepts and postulates	
1. Distance between points	1. Find the distance between two points on a number line;
2. Distance postulates	2. Identify and use the distance postulates.
B. Betweenness	B. Determine the relative position of points using betweenness concepts.
C. Segments, rays, and midpoints	
1. Definitions	1. Define segments, ray and the midpoint of a segment;
2. Symbolism	2. Use appropriate symbols to name segments and rays;
3. Midpoints	3. Find the coordinate of the midpoint.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
IV. Lines and Planes	To demonstrate an understanding of lines and planes, the student will be able to:
A. Terminology and postulates	
1. Definition	1. Define collinear, noncollinear, coplanar, and noncoplanar;
2. Postulates	2. Recognize and use the postulates concerning lines and planes.
B. Existence and uniqueness theorems	B. State and use the existence and uniqueness theorems associated with two intersecting lines, a line and a point not on it, and a line intersecting a plane not containing it.
C. Separation postulates	C. State and use the plane and space separation postulates of a segment.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
V. Angles and Triangles	To demonstrate an understanding of angles and triangles, the student will be able to:
A. Angles	
1. Definitions	1. Define angle, interior of an angle, exterior of an angle;
2. Symbolism	2. Use appropriate symbolism to name angles.
B. Triangles	
1. Definitions	1. Define triangle, interior of a triangle, exterior of a triangle;
2. Symbolism	2. Use appropriate symbolism to name triangles and/or parts of triangles.
C. Formal proofs	C. Write, in logical order, the steps of a formal proof.
D. Angle measurement	
1. Postulates	1. Recognize and use the postulates associated with angle measure and construction;
2. Definition and identification	2. Define and identify acute angles, obtuse angles, linear pairs, etc.;
3. Angle - addition postulate or theorem	3. Complete simple proofs using angle - addition.
E. Perpendicularity	
1. Definition	1. Define perpendicular lines;
2. Theorems	2. Prove theorems involving linear pairs (adjacent supplementary angles or exterior sides are opposite rays) and perpendicular lines.
F. Betweenness	1. Complete simple proof using concept of betweenness.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VI. Parallel Lines	To demonstrate an understanding of parallel lines, the student will be able to:
A. Terminology	A. Identify and/or define geometric terms related to parallelism.
B. Parallel Postulate	B. Use the Parallel Postulate to prove theorems concerning parallel lines.
C. Theorems	C. Apply theorems that involve:
1. Alternate interior angles	1. Transversals and alternate interior angles;
2. Corresponding angles	2. Transversals and corresponding angles;
3. Perpendicular lines	3. Two coplanar lines perpendicular to the same line;
4. Parallel	4. Two lines parallel to the same line.
D. Triangles	D. Realize the significance of the Parallel Postulate in proving theorems and corollaries concerning the sum of the measures of the angles of a triangle.
E. Perpendicular lines	
1. Existence and uniqueness theorems	1. Illustrate and use theorems that establish the existence and uniqueness of:
a. On the line	a. A line in a plane perpendicular to a point on the line
b. Not on the line	b. A line perpendicular to a line from a point not on the line
2. Perpendicular bisector or definition theorem	2. Prove and use the Perpendicular Bisector Theorem or definition.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
VII. Congruent Triangles	To demonstrate an understanding of congruent triangles, the student will be able to:
A. Definition	A. Define congruent triangles.
B. Notation	B. Use correct notation in writing vertex correspondences between congruent triangles.
C. Theorem and postulates	
1. Identification	1. Name or identify four methods (SAA, SAS, ASA, SSS) of proving triangles congruent; Note: Other methods using right triangles should be taught later. (Hypotenuse-Leg, Hypotenuse-Angle, Leg-Leg, and Leg-Angle).
2. Formal proofs for congruent triangles	2. Write, in logical order, the steps of a formal proof;
3. Isosceles triangle theorem	3. Use the Isosceles Triangle Theorem and its converse in writing formal proofs.
D. Median and angle bisectors	
1. Definition	1. Define a median and an angle bisector of a triangle;
2. Applications	2. Use the properties of medians and angle bisectors to prove triangles congruent.
E. Quadrilaterals	
1. Definitions	1. Define: a. Quadrilateral b. Parallelogram c. Rectangle d. Square

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
Congruent Triangles (Continued)	
	e. Rhombus
	f. Trapezoid
2. Properties	2. Discover the properties of angles and/or sides and/or diagonals of:
	a. Parallelograms
	b. Rectangles
	c. Squares
	d. Rhombuses
	e. Trapezoids

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VIII. Methods of Reasoning	To demonstrate an understanding of methods of reasoning, the student will be able to:
A. Induction	
1. Definition	1. Define reasoning by induction;
2. Identification	2. Recognize conclusions that are made inductively.
B. Deduction: conjunction, disjunction and truth tables:	
1. Definition	1. Define reasoning by deduction;
2. Identification	2. Validate conclusions that are made deductively;
3. Application	3. Make valid conclusions by applying deductive reasoning;
	4. Define conjunction, disjunction and validate these elements by the use of truth tables.
C. Principles of logic	
1. Conditionals	
a. Definition	a. Define a conditional
b. Hypothesis	b. Identify the hypothesis of a conditional
c. Conclusion	c. Identify the conclusion of a conditional
d. Applications	d. Write a statement in "if-then" form
e. Classification	e. Determine if a given statement is true or false

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Methods of Reasoning (Continued)	
2. Converses	
a. Definition	a. Define the converse of a statement
b. Applications	b. Write the converse of a statement
c. Classification	c. Determine if the converse of a statement is true or false
3. Inverses	
a. Definition	a. Define the inverse of a statement
b. Application	b. Write the inverse of a statement
c. Classification	c. Determine if the inverse of a statement is true or false
4. Contrapositive	
a. Definition	a. Define the contrapositive of a statement
b. Application	b. Write the contrapositive of a statement
c. Classification	c. Determine that the contrapositive of a true statement is true
5. Biconditional statements	
a. Definition	a. Define the biconditional of a statement
b. Application	b. Write the biconditional of a statement
c. Classification	c. Determine that the biconditional of a true statement is true

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Methods of Reasoning (Continued)	
6. Law of Contrapositives	
a. Definition	a. Define the contrapositive of a statement
b. Application	b. Write the contrapositive of a statement
c. Classification	c. Determine that the contrapositive of a true statement is true
D. Indirect proof	
1. Negation of a statement	1. Write the negation of a statement;
2. Procedure	2. Use the negation of the conclusion together with the hypothesis to arrive at a contradiction;
3. Conclusion	3. Recognize the contradiction to verify that the conclusion is valid.
E. Auxiliary Sets	
1. Definition	1. Define an auxiliary set of points;
2. Application	2. Introduce and use auxiliary sets in writing proofs.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
IX. Triangles and Inequalities	To demonstrate an understanding of triangles and inequalities, the student will be able to:
A. Exterior angle	A.
1. Definition	1. Define and recognize an exterior angle of a triangle;
2. Exterior angle theorem	2. Use the exterior angle theorem to solve related exercises.
B. Other congruence theorems	B.
1. Hypotenuse-leg theorem	1. Use the hypotenuse-leg theorem to prove triangles congruent;
2. Hypotenuse-angle theorem	2. Use the hypotenuse-angle theorem to prove triangles congruent;
3. Leg-leg theorem	3. Use the leg-leg theorem to prove triangles congruent;
4. Leg-angle theorem	4. Use the leg-angle theorem to prove triangles congruent.
C. Inequalities in one triangle	C. State and use the theorems concerning the lengths of sides of a triangle with respect to the measurement of its angles.
D. Inequalities in two triangles	D. State and use the theorems concerning the comparative lengths of sides and measures of angles of two triangles.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
X. Similar Triangles	To demonstrate an understanding of similar triangles, the student will be able to:
A. Ratio and proportion	A.
1. Definitions	1. Define:
	a. Ratio
	b. Proportion
2. Computations	2. Find missing terms in proportions;
3. Writing proportions	3. Write proportions from given data.
B. Basic proportionality theorem	B. Use the Basic Proportionality Theorem to solve selected exercises.
C. Similarity theorems	C. Prove triangles similar by:
	1. Angle-Angle-Angle;
	2. Side-Angle-Side;
	3. Side-Side-Side.
D. Mean proportions and right triangles	
1. Mean proportion	1. Find the mean proportion between two non-zero numbers;
2. Right triangles	2. Use mean proportions to find the lengths of sides of right triangles.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
XI. Area	To demonstrate an understanding of area, the student will be able to:
A. Pythagorean Theorem	A. Use area concepts to prove the Pythagorean Theorem and its converse.
B. Special right triangles	B. Find the lengths of sides of:
1. 30-60-90 right triangles	1. A 30-60-90 right triangle given the length of one side of the triangle;
2. Isosceles right triangles	2. An isosceles right triangle given the length of one side of the triangle.
C. Square, rectangle and triangle	C. Find the area of squares, rectangles and triangles.
D. Parallelogram and trapezoid	D. Find the area of parallelograms and trapezoids.
E. Ratio of areas	E. Find the ratio of areas and lengths of sides of similar triangles.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
XII. Circles	To demonstrate an understanding of circles, the student will be able to:
A. Terminology	A. Define and/or identify geometric terms associated with circles.
B. Chords and tangents	B. Prove and/or use the basic theorems that are related to chords of a circle and tangents to a circle.
C. Measurement of arcs and angles	C. Prove and/or use the basic definitions and theorems that are associated with arcs and angles of a circle.
D. Common tangents and tangent circles	
1. Common tangents	1. Define and identify common tangents of two circles;
2. Tangent circles	2. State the conditions for which two circles are tangent;
3. Theorems	3. Apply theorems associated with common tangents and tangent circles to related exercises.
E. Theorems concerning segments	
1. Secant segments	1. State and apply theorems concerning the lengths of secant segments of circles;
2. Tangent segments	2. State and apply theorems concerning the lengths of tangent segments of circles.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
XIII. Construction	To demonstrate an understanding of construction, the student will be able to:
A. Concurrency theorems	A. State and use the concurrency theorems concerning:
1. Angle bisectors	1. Angle bisectors of a triangle;
2. Perpendicular bisectors	2. Perpendicular bisectors of the sides of a triangle;
3. Medians	3. Medians of a triangle;
4. Altitudes	4. Altitudes of a triangle.
B. Basic constructions	B. Use a straight edge and compass to:
	1. Copy a segment;
	2. Copy an angle;
	3. Bisect an angle and a segment;
	4. Construct lines perpendicular to a given line;
	5. Construct lines parallel to a given line;
	6. Copy triangles;
	7. Subdivide a segment into congruent parts;
	8. Inscribe triangles in circles and circles in triangles;
	9. Circumscribe circles about triangles and triangles about circles;
	10. Construct tangents to circles.
C. Applications	C. Use the basic constructions to construct figures illustrating given conditions.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVE
XIV. Circular and Polygonal Regions	To demonstrate an understanding of circular and polygonal regions, the student will be able to:
A. Polygons	
1. Definitions and identification	1. Define a polygon and name selected polygons;
2. Degree measure	2. Find the sum of the measures of the angles of an n-gon;
3. Diagonals	3. Determine the number of diagonals in any polygon;
4. Exterior angles	4. Find the sum of the measures of the exterior angles an any polygon.
B. Regular polygons	
1. Definitions	1. Define a regular polygon;
2. Measure of angles	2. Find the degree measure of each angle of any regular polygon;
3. Area	3. Find the area at regions bounded by selected regular polygons.
C. Circles	
1. Circumference	1. Find the circumference of a circle;
2. Area	2. Find the area of a circular region.
D. Sectors and arcs	
1. Sectors	1. Find the areas of sectors of circular regions;
2. Arcs	2. Find the lengths of arcs of circles.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
XV. Volume	Performance Objectives
A. Prism, pyramid, cone, cylinder, sphere	A. Find lateral area, total area and volume of these figures. 1. Identify these figures; 2. Define lateral area, total area, and volume.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
XVI. Coordinate Geometry	To demonstrate an understanding of coordinate geometry, the student will be able to:
A. Definitions and identification	A. Define and/or identify terms associated with a two dimension coordinate system.
B. Slope of segments and lines	
1. Segments	1. Find the slope of a segment given the coordinates of its endpoints;
2. Graph	2. Find the slope of a line given the graph of the line.
C. Distance and midpoint formulas	
1. Distance formula	1. Find the distance between two points by using a formula;
2. Midpoint of segment	2. Find the midpoint of a segment given the coordinates of its endpoints.
D. Equation and lines	D. Find an equation of a line given.
1. Slope and y-intercept	1. The slope of the line and its y-intercept;
2. Two points	2. The coordinates of two points of the line;
3. Point and slope	3. The coordinates of a point on the line and the slope of the line.
E. Equations of parallel and perpendicular lines	
1. Parallel lines	1. Find an equation of a line parallel to a given line;
2. Perpendicular lines	2. Find an equation of a line perpendicular to a given line.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Coordinate Geometry (Continued)	
F. Graphs	F. Graph lines given.
1. Slope of y-intercept	1. The slope of the line and its y-intercept;
2. Point and slope	2. A point of the line and its slope;
3. Equation of line	3. An equation of the line.
G. Proofs by coordinate method	G. Prove theorems by coordinate methods.

ACTIVITIES

ACTIVITIES

I. A. **CONTENT:** Introduction to Geometry; Undefined Terms and Basic Postulates

OBJECTIVE: The student will be able to:

(a) Name the undefined terms of geometry;

(b) Identify and use the basic postulates of geometry.

ACTIVITIES:

(a) Name three undefined terms that are used in the development of geometry.

(b) Identify the criteria necessary for building a mathematical system.

(c) Supply the missing word or words to make a true statement.

(1) Given any two points there is exactly _____ that contains them.

(2) If two points of a _____ are contained in a plane the _____ is contained in the plane.

(3) Every plane contains at least _____ points.

(4) If two _____ intersect, then their intersection is a line.

Space contains at least _____.

II. A. **CONTENT:** Real Numbers; Order Properties

OBJECTIVE: The student will be able to name, recognize and use the order properties of the real numbers.

ACTIVITIES:

Name the order property that justifies each of the following:

(a) If $a < b$ than $a + 2 < b + 2$.

(b) Either $x = y$, $x > y$ or $x < y$.

(c) If $a < b$ then $2a < 2b$.

(d) If $x + 2 = y$ then $x < y$.

(e) If $x < y$ and $2 < 3$ then $x + 2 < y + 3$.

II. B. **CONTENT:** Real Numbers, Absolute Value

OBJECTIVE: The student will be able to find the absolute value of real numbers.

ACTIVITIES:

Complete.

(a) $|-3| =$ ___?___.

(b) $|7-2| =$ ___?___.

(c) $|-8-6| =$ ___?___.

(d) $|-6| - |-2| =$ ___?___.

(e) $|a| =$ _____ if $a < 0$.

(f) $|-a| =$ _____ if $-a > 0$.

(g) $|a-b| =$ _____ if $a < b$.

III. A. (1,2)

CONTENT: Distance; Distance Concepts and Postulates

OBJECTIVE: The student will be able to:

(a) Find the distance between two points of a line;

(b) Identify and use the distance postulates.

ACTIVITIES:

Find the distance between two points that have the following coordinates.

(a) 5 and 19

(b) -5 and -8

(c) -5 and 12

(d) x and y

(e) -2 and x

III. B.

CONTENT: Distance, Betweenness

OBJECTIVE: The student will be able to determine the relative position of points by using betweenness concepts.

ACTIVITIES:

(a) If A, B, and C are three points of a line, state in each case which point is between the other two.

(1) AC + CB = AB

(2) BA + AC = BC

(3) BC = AB = AC

(4) AC = AB - BC

(b) A, B, and C are points of a line and B is between A and C. The coordinate of B is -6, AB = 4 and BC = 8. Find the possible coordinates of A and C.

III. C. (1,2,3)

CONTENT: Distance; Segments; Rays and Midpoints

OBJECTIVE: The student will be able to:

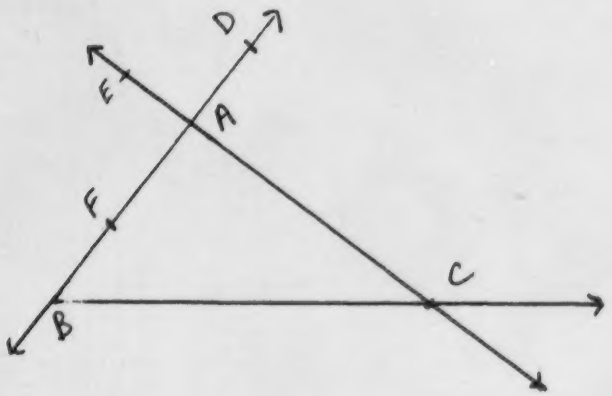
(a) Define segment, ray and midpoint of a segment;

(b) Use appropriate symbols to identify segments and rays;

(c) Find the coordinate of the midpoint of a segment.

ACTIVITIES:

(a) Complete.



(1) $\overline{BF} \cup \overline{FA} = ?$

(2) $\overrightarrow{EC} \cap \overrightarrow{AC} = ?$

(3) $\overrightarrow{AF} \cap \overrightarrow{BA} = ?$

(4) $\overrightarrow{AC} \cap \overrightarrow{AE} = ?$

(5) $\overrightarrow{BF} \cup \overrightarrow{FA} = ?$

(6) $\overline{FB} \cup \overrightarrow{FD} = ?$

(b) Determine in each case, which point (A, B, or C) is between the other two.

(1) $\overrightarrow{CA} + \overrightarrow{AB} = \overrightarrow{CB}$

(2) $\overrightarrow{AC} \cap \overrightarrow{BC} = \overrightarrow{AC}$

(3) $\overrightarrow{AC} \cup \overrightarrow{CB} = \overrightarrow{AB}$

(4) $\overrightarrow{BA} \cap \overrightarrow{AC} = \overrightarrow{AC}$

(5) $\overrightarrow{AC} \cap \overrightarrow{BA} = \overrightarrow{AB}$

(c) Find the coordinate of the midpoint of segment $\overline{PQ}$ given that the coordinates of P and Q are:

(1) -3 and 11

(2) -8 and -18

(3) 10 and 22

(4) x and y

(d) B is the midpoint of $\overline{AC}$. If the coordinate of A is -10 and AB = 12, find the possible coordinates of C.

IV. A.B. CONTENT: Lines and Planes; Terminology and Postulates; Existence and Uniqueness Theorems

OBJECTIVE: The student will be able to:

(a) Define collinear, coplanar, noncollinear, noncoplanar;

(b) State and use the postulates and existence and uniqueness theorems concerning lines and planes.

ACTIVITIES:

(a) Points A, B, and C are three noncollinear points that are contained in plane E. Line ℓ intersects plane E at A and $\ell \not\subset E$.

(1) Draw a diagram illustrating the information above.

(2) How many planes can contain A, B, and C. Why?

(3) Does every point of $\overleftrightarrow{AB}$ lie in E? Why

(4) Can $\ell \cap E$ be two points? Why?

How many planes can contain ℓ? How many planes can contain ℓ and $\overleftrightarrow{AB}$? Why?

(b) How many planes contain:

(1) Two intersecting lines?

(2) A line and a point on the line?

(3) Three collinear points?

(4) Three noncollinear points?

(5) A line and a point not on the line?

IV. C. CONTENT: Lines and Planes, Separation Postulates

OBJECTIVE: The student will be abe to state and use the plane and space separation postulates.

ACTIVITIES:

(a) Consider the various positions of three lines in a plane. Can the union of the lines separate the plane into four regions? five regions? six regions? seven regions?

(b)

(1) Can the union of two half-planes be a plane? a half-plane?

(2) Can the intersection of two half-planes be a half-plane?

(3) Can the union of two half-spaces be a space? a half space?

(4) Can the intersection of two half-spaces be a half-space?

V. A,B

CONTENT: Angles and Triangles; Definitions and Symbols

OBJECTIVE: The student will be able to:

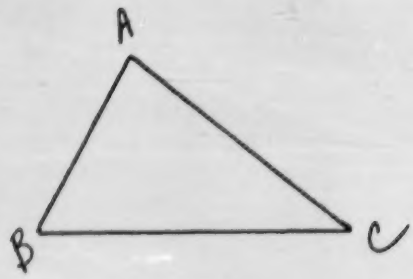
(a) Define angle, triangle, exterior of angles;

(b) Use appropriate symbolism to name angles, triangles and/or parts of triangles.

ACTIVITIES:

(a) Which angles in the diagram require the use of the three letter form for naming angles?

(b)



Use the diagram and name:

(1) The side opposite ∠B.

(2) The side included by ∠A and ∠C.

(3) The angle included by $\overline{BC}$ and $\overline{AC}$.

(4) The angle opposite $\overline{AB}$.

V. C.

CONTENT: Angles and Triangles, Triangles, Formal Proofs

OBJECTIVE: The student will be able to write, in logical order, the steps of a formal proof.

ACTIVITIES: Give a formal proof:

Given: $3x - 4 = 5$

Prove: $x = 3$

V. D. CONTENT: Angles and Triangles; Angle Measurement; Postulates and Definitions

OBJECTIVE: The student will be able to:

(a) Recognize and use the postulates associated with angle measurement and construction;

(b) Define acute angles, obtuse angles, etc.

ACTIVITIES:

(a) (1) Name the sides of ∠ACB.

(2) Point B is in the interior of which angle?

(3) Name a right angle.

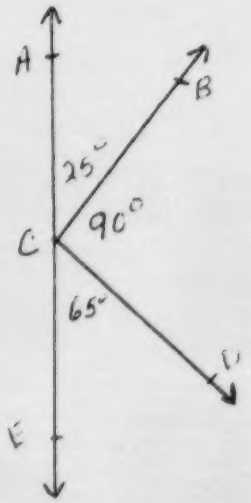
(4) Find two obtuse angles.

(5) Find two acute angles.

(6) Point D is contained in the exterior of which angle?

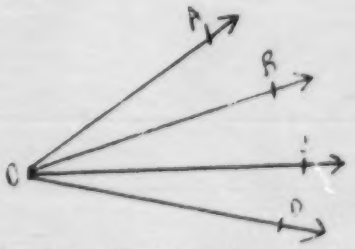
(7) Find two pairs of angles that are supplementary.

(8) Find two angles that are complementary.



(b) Given: m∠AOB = m∠COD

Prove: m∠AOC = m∠BOD



V. E. CONTENT: Angles and Triangles, Perpendicularity, Congruent Angles

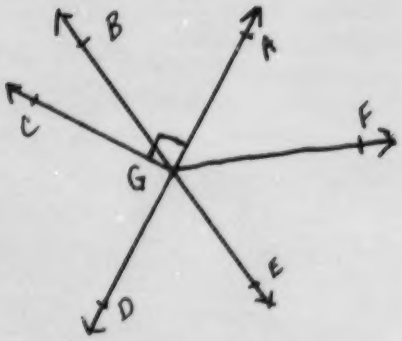
OBJECTIVE: The student will be able to:

(a) Define perpendicular lines and congruent angles;

(b) Prove theorems involving linear pairs and perpendicular lines;

(c) Prove theorems concerning congruent angles, supplements of congruent angles, etc.

ACTIVITIES:



(a)

(1) Name two adjacent angles.

(2) Identify two linear pairs of angles.

(3) m∠CGD = _____.

(4) Find two angles that are supplementary to ∠BGA.

(5) Find two angles that are complementary to ∠CGB.

(6) Find two pairs of vertical angles.

(7) Find two pairs of congruent angles.

(b) Supply the missing information to make a true statement.

(1) Vertical angles are _____.

(2) Supplements of congruent angles are _____.

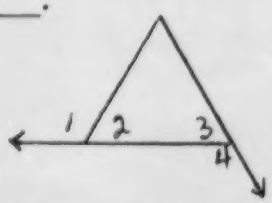
(3) Complements of congruent angles are _____.

(4) Each angle has a measure between _____ and _____.

(5) If two congruent angles are supplementary, then _____.

(c) Given ∠2 ≅ ∠3

Prove ∠1 ≅ ∠4



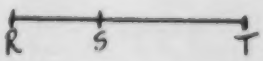
V. F CONTENT: Angles and Triangles; Betweenness

OBJECTIVE: The student will be able to complete simple proof using concept of betweenness.

ACTIVITIES:

Given: S lies between R and T

Prove: ST = RT - RS



VI. A, B. CONTENT: Parallel Lines; Terminology; Parallel Postulate

OBJECTIVE: The student will be able to:

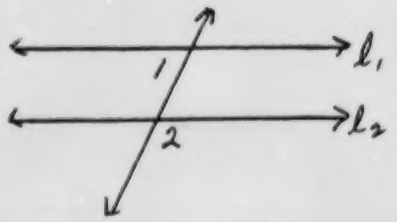
(a) Identify and/or define geometric terms related to parallelism;

(b) State and use the Parallel Postulate.

ACTIVITIES:

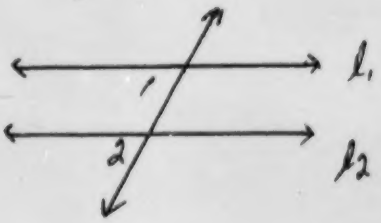
(a) Given: $\angle 1 \cong \angle 2$

Prove: $\ell_1 \| \ell_2$



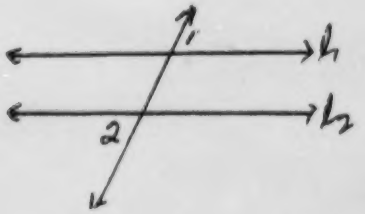
(b) Given: $\angle 1$ supp. $\angle 2$

Prove: $\ell_1 \| \ell_2$



(c) Given: $\angle 1 \cong \angle 2$

Prove: $\ell_1 \| \ell_2$

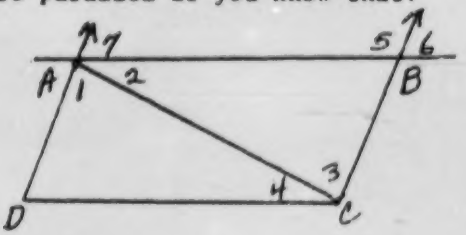


(d) Which segments are parallel if you know that:

(1) $\angle 1 \cong \angle 3$

(2) $\angle 2 \cong \angle 4$

(3) $\angle 7 \cong \angle 6$



VI. C. CONTENT: Parallel Lines; Theorems

OBJECTIVE: The student will be able to apply theorems that involve:

(a) Transversals and alternate interior angles;

(b) Transversals and corresponding angles;

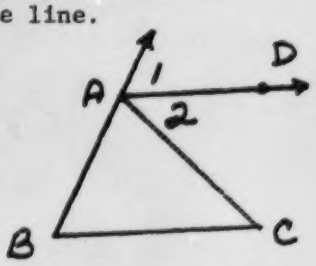
(c) Two coplanar lines perpendicular or parallel to the same line.

ACTIVITIES:

(a) Given: $\angle 1 \cong \angle 2$

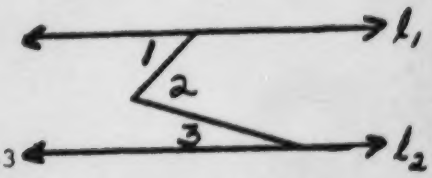
$\overline{AD} \parallel \overline{BC}$

Prove: AB = AC

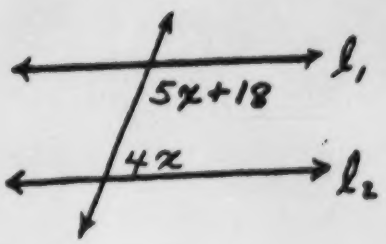


(b) Given: $\ell_1 \parallel \ell_2$

Prove: $m\angle 2 = m\angle 1 + m\angle 3$



(c) Find x so that $\ell_1 \parallel \ell_2$

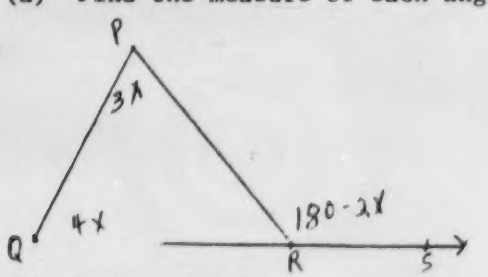


VI. D. CONTENT: Parallel Lines; Triangles

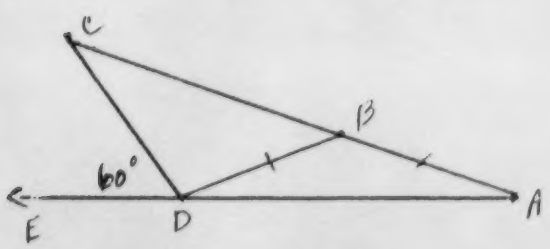
OBJECTIVE: The student will be able to use the theorems and corollaries concerning the sum of the measures of the angles of a triangle.

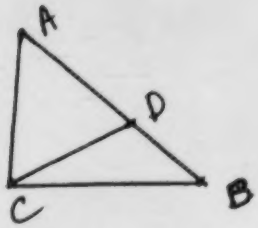
ACTIVITIES: Parallel Lines, Triangles.

(a) Find the measure of each angle of the triangle.



(b) Find the measure of angle A.





(c) Given: AD = DB = DC

Prove: ΔABC is a right triangle

VI. E. (1)

CONTENT: Parallel Lines; Perpendicular Lines; Existence and Uniqueness Theorems

OBJECTIVE: The student will be able to illustrate and use theorems that establish the existence and uniqueness of:

(a) A line in a plane perpendicular to a line at a point of the line;

(b) A line perpendicular to a line from a point not on the line.

ACTIVITIES:

(a) How many lines can be drawn perpendicular to a line at a point of the line.

(b) Prove that no triangle can contain two right angles.

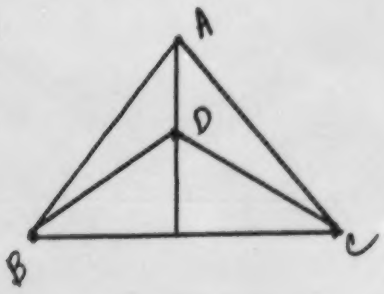
VI. E. (2)

CONTENT: Parallel Lines; Perpendicular Lines; Perpendicular Bisector Theorem or Definition

OBJECTIVE: The student will be able to prove the Perpendicular Bisector Theorem or use the definition.

ACTIVITIES:

(a)

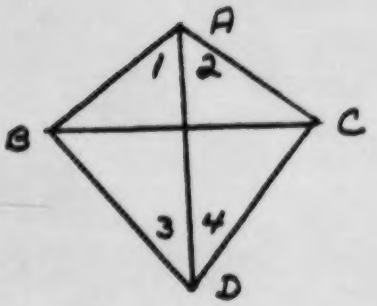


Given: AB = AC

DB = DC

Prove: $\overleftrightarrow{AD} \perp$ bisector of $\overline{BC}$

(b)



Given: $\angle 1 \cong \angle 2$

$\angle 3 \cong \angle 4$

Prove: $\overleftrightarrow{AD} \perp$ bisector of $\overline{BC}$

VII. A, B **CONTENT:** Congruent Triangles; Definitions and Notation

OBJECTIVE: The student will be able to:

(a) Define congruent triangles;

(b) Use correct notation in writing vertex correspondences between congruent triangles.

ACTIVITIES:

(a) If $\triangle ABC \cong \triangle DEF$, write the six pairs of congruent parts.

(b) Triangle ABC and $\triangle DEF$ are such that $\overline{FE} \leftrightarrow \overline{AC}$ and $\overline{DF} \leftrightarrow \overline{BA}$. Write the correct vertex correspondence.

(c) Triangle ABC and $\triangle DEF$ are such that $\angle B \leftrightarrow \angle E$ and $\overline{AB} \leftrightarrow \overline{ED}$. Write the correct vertex correspondence.

VII. C. (1) **CONTENT:** Congruent Triangles; Theorems and Postulates; Identification

OBJECTIVE: The student will be able to name or identify three methods of proving triangles congruent.

ACTIVITIES:

By what method could you prove that $\triangle PQR \cong \triangle PSR$ if you are given that:

(a) $\angle 1 \cong \angle 2$, $\angle 6 \cong \angle 5$

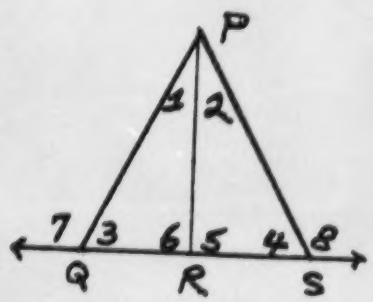
(b) $\angle 7 \cong \angle 8$, QR = RS, $\angle 5 \cong \angle 6$

(c) PQ = PS, QR = RS

(d) $\angle 1 \cong \angle 2$, PQ = PS

(e) $\angle 3 \cong \angle 4$, PQ = PS

R is the midpoint of $\overline{QS}$



VII. C. (2) **CONTENT:** Congruent Triangles; Theorems; Postulates; Formal Proofs

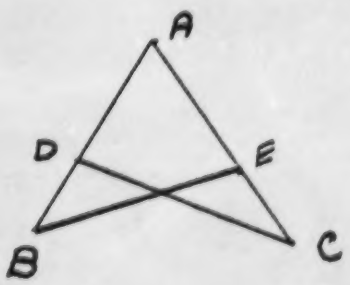
OBJECTIVE: The student will be able to write, in logical order, the steps of a formal proof.

ACTIVITIES:

(a) Given AB = AC

BD = EC

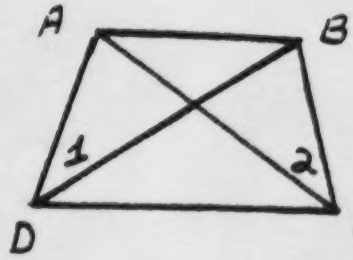
Prove: CD = BE



(b) Given: AD = BC

AC = BD

Prove: $\angle 1 \cong \angle 2$

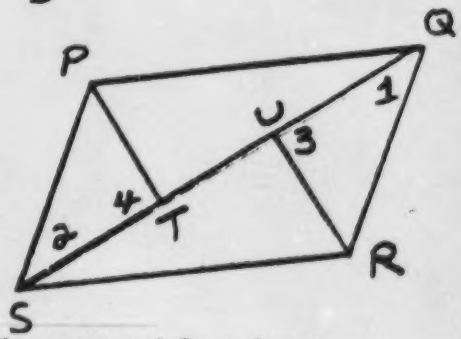


(c) Given: $\angle 3 \cong \angle$

$\angle 1 \cong \angle 2$

SU + QT

Prove: PQ = SR



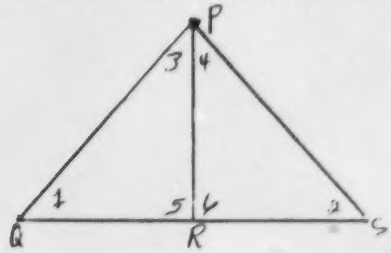
VII. C.
(3)

CONTENT: Congruent Triangles; Theorems and Postulates; Isosceles Triangle Theorem

OBJECTIVE: The student will be able to use the Isosceles Triangle Theorem and its converse in writing formal proofs.

ACTIVITIES:

(a) By what method or methods could you prove that $\Delta PQR \cong \Delta PSR$ if you are given that:



(1) $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$

(2) PQ = PS, QR = RS

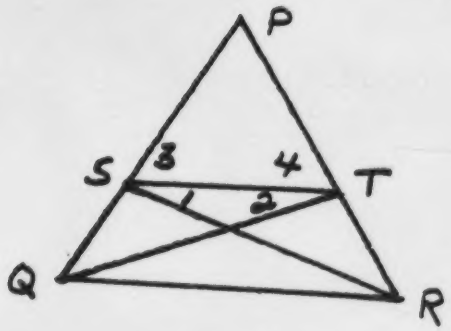
(3) $\angle 1 \cong \angle 2$, QR = RS

(4) $\angle 3 \cong \angle 4$, PQ = PS

(b) Given: $\angle 1 \cong \angle 2$

$\angle 3 \cong \angle 4$

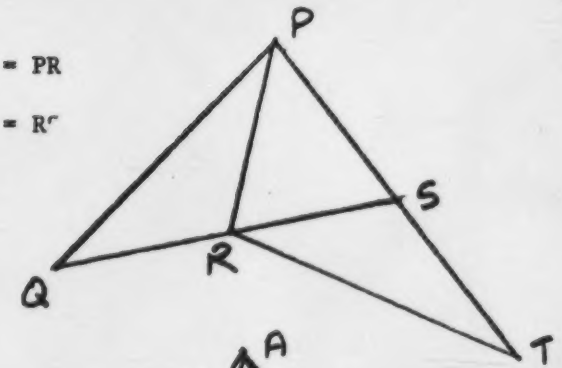
Prove: $RS = QT$



(c) Given: $PS = ST = PR$

$QR = R$

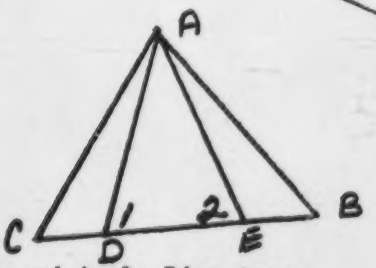
Prove: $\angle Q \cong \angle T$



(d) Given: $\angle 1 \cong \angle 2$

$CE = DB$

Prove: $\angle CAE \cong \angle BAD$



VII. D. CONTENT: Congruent Triangle; Medians and Angle Bisectors

OBJECTIVE: Students will use definitions of medians and angle bisectors to prove triangles congruent.

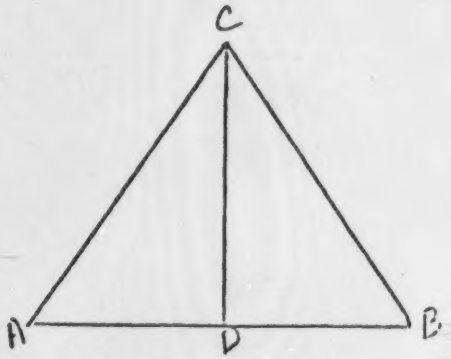
ACTIVITIES:

(a) Given: $\overline{AD}$ bisects $\angle BAC$

$\overline{AB} \cong \overline{AC}$

Prove: $\triangle ABD \cong \triangle ACD$

(b)



Given: $\overline{AC} \cong \overline{BC}$
$\overline{CD}$ is a Median

Prove: $\triangle ADC \cong \triangle BDC$

VII. E. CONTENT: Parallel Lines; Quadrilaterals; Definitions and Properties

OBJECTIVE: The student will be able to define and discover the properties of:

(a) Quadrilaterals

(b) Parallelograms

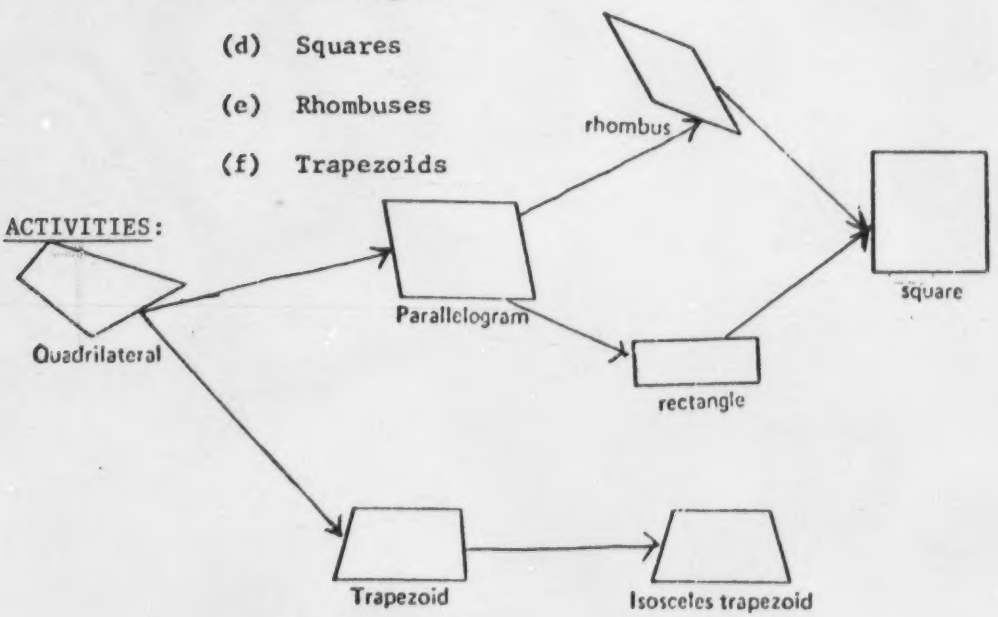
(c) Rectangles

(d) Squares

(e) Rhombuses

(f) Trapezoids

ACTIVITIES:



(a) For which of the quadrilaterals identified in this section is it true that:

(1) The diagonals bisect each other?

(2) Opposite angles are congruent?

(3) The diagonals are perpendicular?

(4) The diagonals are congruent?

(5) Each diagonal bisects two angles?

(b) In each exercise determine if the information given for quadrilateral ABCD is sufficient to prove that it is a parallelogram, a rectangle, a square, a rhombus.

(1) The diagonals bisect each other.

(2) The opposite angles are congruent.

(3) The diagonals are perpendicular and congruent.

(4) Each diagonal bisects two angles.

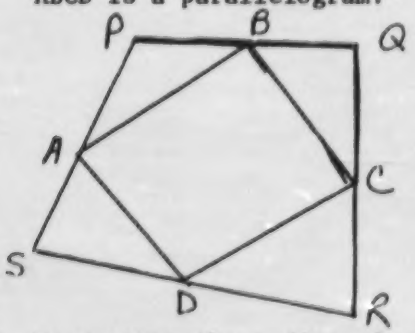
(5) The diagonals are congruent.

(6) All sides are congruent.

(7) Each pair of opposite sides are parallel.

(8) A diagonal subdivides the quadrilateral into two congruent triangles.

(c) If A, B, C, and D are the midpoints of the sides of quadrilateral PQRS, prove that quadrilateral ABCD is a parallelogram.

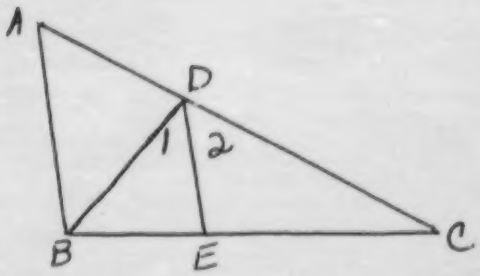


(d) Prove that the median of a trapezoid is parallel to the bases and has length equal to one-half the sum of the lengths of the bases.

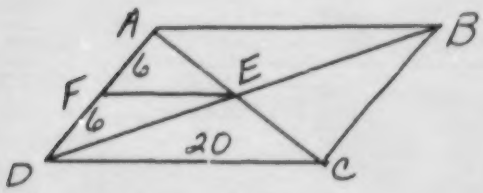
(e) Given: $\overline{DE} \parallel \overline{AB}$

$\angle 1 \cong \angle 2$

Prove: AD = DB



(f) ABCD is a parallelogram. Use the diagram and find FE.



VIII. A,B. (1,2)

CONTENT: Methods of Reasoning; Induction and Deduction; Definitions and Identification

OBJECTIVE: The student will be able to:

(a) Define reasoning by induction and deduction;

(b) Recognize conclusions that are made by induction and deduction.

ACTIVITIES:

(a) Complete.

(1) General conclusions that are made from observations of specific cases are examples of _____(inductive, deductive) reasoning.

(2) _____reasoning applies a general statement to a specific case.

(b) Determine in each part whether the reasoning is inductive or deductive.

(1) Joe saw ten steers and each of them had horns. He concluded that all steers have horns.

(2) Every integer is either odd or even and this integer is not odd. Therefore, it is even.

(3) Since $\frac{5}{5} = 1$ and $\frac{4}{4} = 1$, $\frac{a}{a} = 1$.

VIII. B. (3)

CONTENT: Methods of Reasoning; Deduction; Application; Conjunction; Disjunction; Truth Tables

OBJECTIVE: The student will be able to make valid conclusions by applying deductive reasoning.

ACTIVITIES: What conclusions, if any, can be made given the following information?

(a) If a person is a good driver, then he does not violate the law. Bill is a good driver.

(b) If it is snowing, then the weather is cold. It is cold outside.

(c) If a triangle is equilateral then it is isosceles. This triangle is not equilateral.

(d) Spot barks whenever a stranger enters the yard. Spot is barking.

VIII. B. (4) CONTENT: Methods of Reasoning; Deduction; Application Conjunction; Disjunction; Truth Tables

OBJECTIVE: The student will be able to define conjunction, disjunction, and validate these elements by use of truth tables.

ACTIVITIES:

(a) Conjunction:

p: John plays tennis.
q: John plays golf.
pΛq: John plays tennis and John plays golf.

p	q	pΛq
T	T	T
T	F	F
F	T	F
F	F	F

(b) Disjunction:

p: John plays tennis.
q: John plays golf.
pVq: John plays tennis or John plays golf.

p	q	pVq
T	T	T
T	F	T
F	T	T
F	F	F

(c) Negation:

p: John plays tennis.
∿p: It is false that John plays tennis.
∿p: John does not play tennis.

p	∿p
T	F
F	T

(d) Write truth tables for each:

(1) PΛ (PVQ)

(2) P V (pVq)

(3) ∿p q V∿q

VIII. C. (1) CONTENT: Methods of Reasoning; Principles of Logic; Conditionals

OBJECTIVE: The student will be able to:

(a) Define a conditional and validate by use of truth tables. Apply the Law of Detachment;

(b) Identify the hypothesis and conclusion of a given statement;

(c) Write a given statement in "if-then" form;

(d) Determine if a given statement is true or false.

ACTIVITIES:

$P \nrightarrow q$

p	q	p↛q
T	T	T
T	F	F
F	T	T
F	F	T

(a) Write truth tables for each:

$(p \wedge q) \nrightarrow \sim\sim P$

$P \rightarrow (\sim p \vee q)$

(b) What conclusions, if any, may be deduced by use of the Law of Detachment? Letters a, b, c, d represent statements.

(1) a; $a \rightarrow b$

(2) $c \rightarrow d$; d

(3) $\sim a$; $\sim a \rightarrow c$

(4) $c \rightarrow a, \sim c$

(5) If Joe lives in Baton Rouge, he lives in Louisiana. Joe lives in Baton Rouge.

(c) Identify the hypothesis and conclusion of each statement.

(1) If $x + 2 = 5$, then $x = 3$.

(2) I live in Louisiana if I live in Baton Rouge.

(3) An isosceles triangle has two congruent sides.

(4) Supplements of congruent angles are congruent.

(d) Write each of the following in "if-then" form.

(1) All right angles are congruent.

(2) Vertical angles are congruent.

(3) Complements of congruent angles are congruent.

(e) Which of the following statements is true?

(1) The product of two odd integers is an odd integer?

(2) For every real number a, $a^2 > a$.

(3) If $\overleftrightarrow{AB}$ $\overleftrightarrow{CD}$ at E, then $\angle AED \cong \angle CEB$. (Be Careful)

VIII. C. (2,3,4,5,)

CONTENT: Methods of Reasoning; Principles of Logic; Converse; Inverse and Contrapositive

OBJECTIVE: The student will be able to define, write and classify:

(a) The converse of a statement;

(b) The inverse of a statement;

(c) The contrapositive of a statement;

(d) The biconditionals of a statement;

(e) The Law of Contrapositive of a statement.

ACTIVITIES:

P	Q	P→Q
T	T	T
T	F	F
F	T	F
F	F	T

(a) Use the table and determine whether each is an equivalence relation.

(1) If a point is on a line, then the line contains the point.

(2) If a number is an integer, then it is a rational number.

(3) If the square of an integer is add, then the integer is odd.

(4) Prove that a conditional is equivalent to its contrapositive by use of a truth table.

VIII. D.

CONTENT: Methods of Reasoning; Indirect Proof

OBJECTIVE: The student will be able to:

(a) Write the negation of a statement;

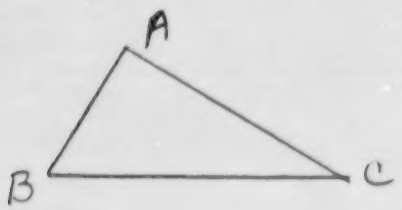
(b) Use a negated statement to arrive at a contradiction;

(c) Recognize the contradiction to verify that the conclusion is valid.

ACTIVITIES:

Use an indirect argument to prove each of the following:

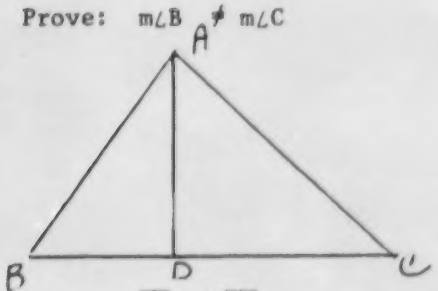
(a)



Given: $AB \neq AC$

Prove: $m\angle B \neq m\angle C$

(b)



Given: $\overline{AD} \perp \overline{BC}$

$AB \neq AC$

Prove: $BD \neq DC$

VIII. E. CONTENT: Methods of Reasoning; Auxiliary Sets

OBJECTIVE: The student will be able to:

(a) Define an auxiliary set of points;

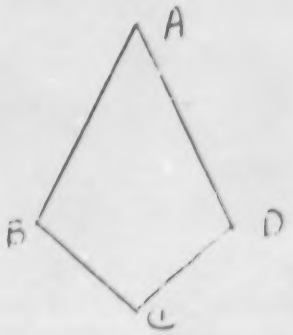
(b) Introduce and use auxiliary sets in formal proofs.

ACTIVITIES:

(a) Given: $AB = AD$

$BC = DC$

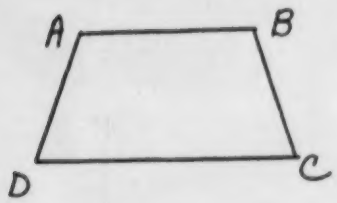
Prove: $m\angle ABC = m\angle ADC$



(b) Given: $m\angle D = m\angle C$

$AD = BC$

Prove: $m\angle A = m\angle B$



IX. A

CONTENT: Triangles and Inequalities; Exterior Angles

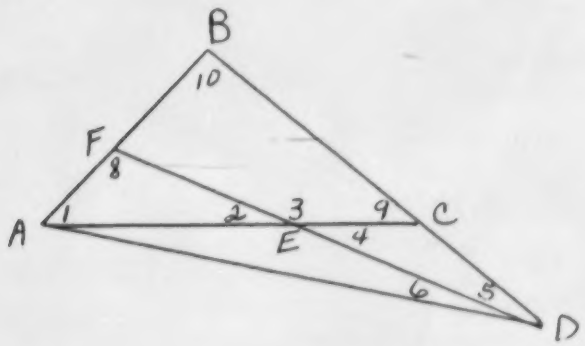
OBJECTIVE: The student will be able to:

(a) Define and recognize an exterior angle of a triangle;

(b) Use the Exterior Angle Theorem to solve related exercises.

ACTIVITIES:

(a)



(1) Find the angles whose measures are less than m∠8. less than m∠2. less than m∠3.

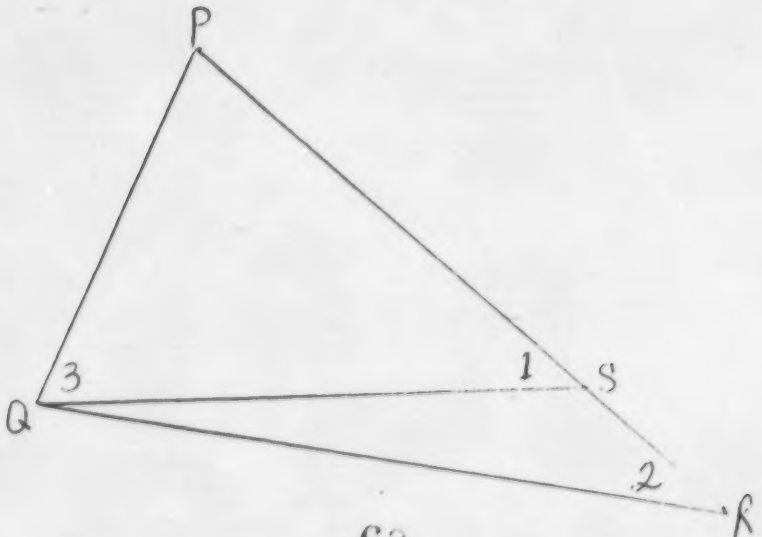
(2) For what triangle is ∠2 an exterior angle?

(3) For what triangle is ∠3 an exterior angle?

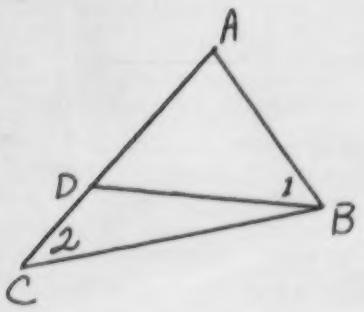
(4) Find four angles whose measures are less than m∠9.

(b) Given: m∠3 > m∠1

Prove: m∠3 > m∠2



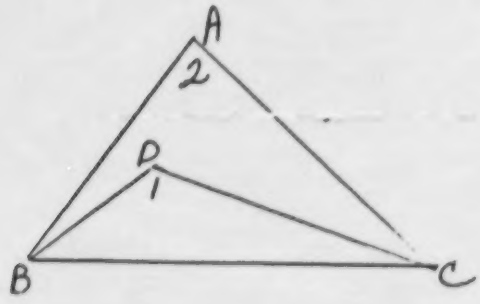
(c)



Given: AB = AD

Prove: m ∠1 > m ∠2

(d)



Prove: m ∠2 < m ∠1

IX. B. CONTENT: Triangles and Inequalities; Other Congruence Theorems

OBJECTIVE: The student will be able to use:

(a) The S. A. A. Theorem to prove triangles congruent;

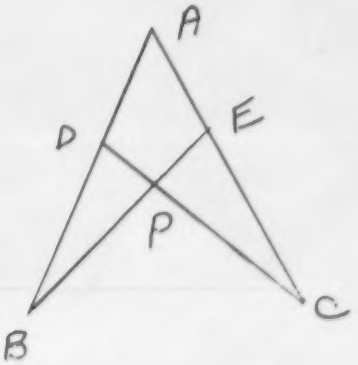
(b) The Hypotenuse-Leg Theorem to prove right triangles congruent.

ACTIVITIES:

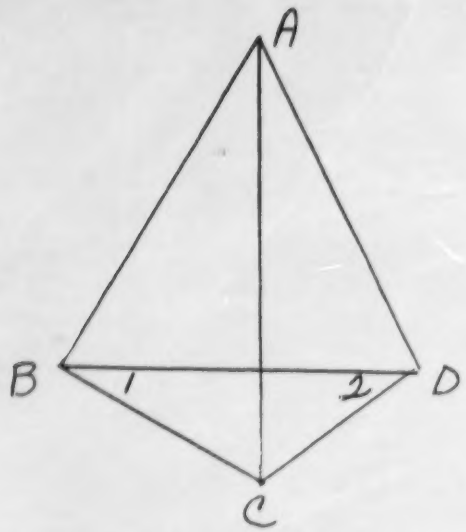
(a) Given: BD = EC

AB = AC

Prove: BP + PC



(b)



Given: $\angle 1 \cong \angle 2$, $\angle ABC$ and $\angle ADC$ are right angles.

Prove: AB = AD by using congruent triangles.

IX. C. CONTENT: Triangles and Inequalities; Inequalities in One Triangle

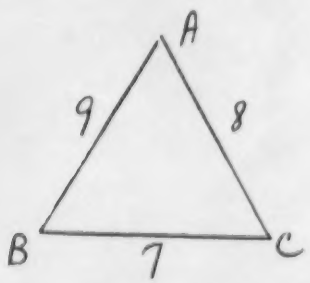
OBJECTIVE: The student will be able to state and use the theorems concerning:

(a) The lengths of sides of a triangle with respect to the measurement of its angles;

(b) The sum of the lengths of two sides of a triangle with respect to the length of the third side.

ACTIVITIES:

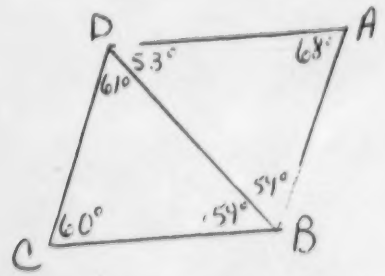
(a)



(1) Name the smallest angle of the triangle.

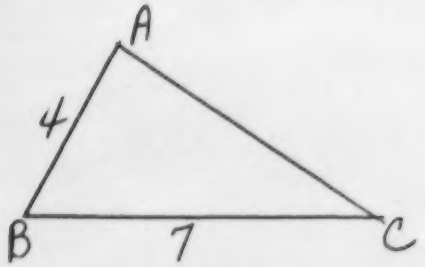
(2) Name the largest angle of the triangle.

(b)



Name the longest segment in the diagram.

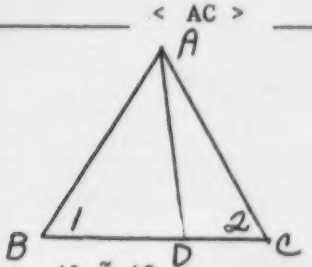
(c)



Find the possible lengths of $\overline{AC}$, that is:

_____ < AC > _____.

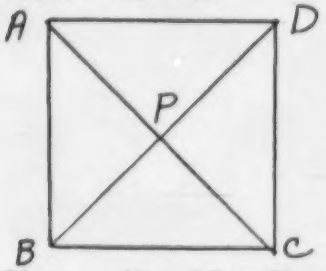
(d)



Given: $\angle 1 \cong \angle 2$

Prove: AB > AD

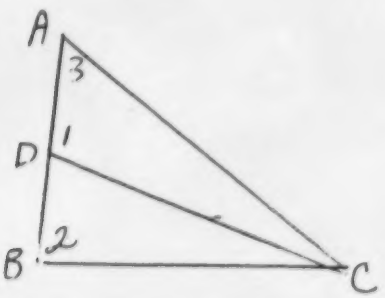
(e)



Given: AB = BC = CD = DA

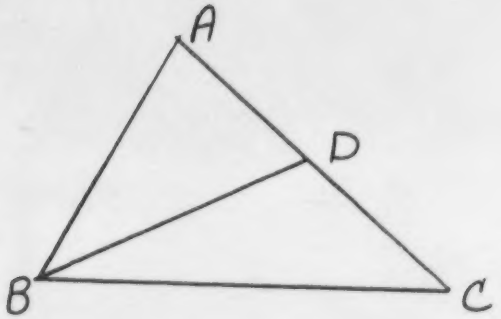
Prove: AB > AP

(f)



Given: m $\angle 3$ < m $\angle 2$

Prove: DC < AC



Brainbuster:

Given: AD = DC

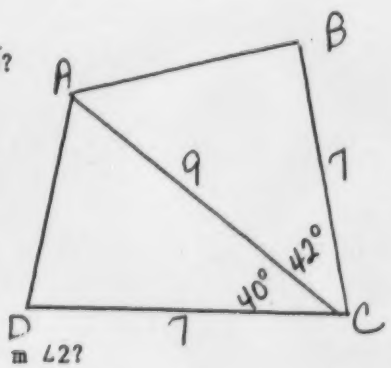
Prove: $BD < \frac{1}{2}(AB + BC)$

IX. D. CONTENT: Triangles and Inequalities; Inequalities in Two Triangles

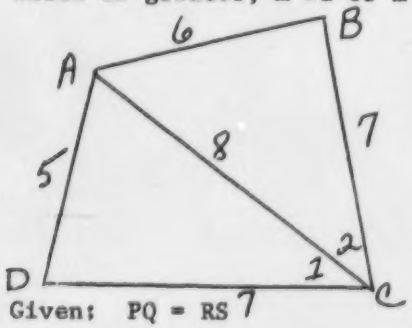
OBJECTIVE: The student will be able to state and use the theorems concerning the comparative lengths of sides and measures of angles of two triangles.

ACTIVITIES:

(a) Which is longer, $\overline{AD}$ or $\overline{AB}$?

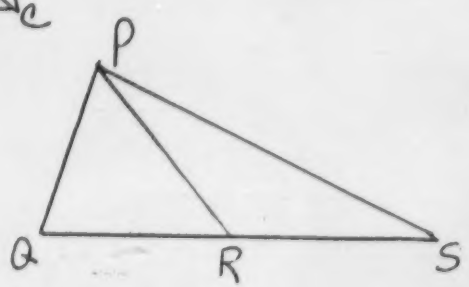


(b) Which is greater, m ∠1 or m ∠2?



Given: PQ = RS

Prove: QR < PS



X. A. CONTENT: Similar Triangles; Ratio and Proportion

OBJECTIVE: The student will be able to:

(a) Define ratio and proportion;

(b) Find missing terms in proportions;

(c) Write proportions from given data.

ACTIVITIES: Supply the missing information.

(a) If $\frac{a}{5} = \frac{3}{4}$ then $\frac{a}{3} = \frac{?}{?}$ and $\frac{a+b}{b} = \frac{?}{?}$.

(b) If $\frac{a}{b} = \frac{7}{3}$ then $\frac{b}{a} = \frac{?}{?}$ and $\frac{3}{b} = \frac{?}{?}$.

(c) If $\frac{x}{2} = \frac{3}{4}$ then $x =$ _____.

(d) If $\frac{6}{5} = \frac{2}{x}$ then $x =$ _____.

(e) If $3x = 5y$, then $\frac{3}{5} = \frac{?}{?}$ and $\frac{y}{3} = \frac{?}{?}$.

(f) If $\frac{a+b}{b} = \frac{7}{6}$, then $\frac{a}{b} = \frac{?}{?}$ and $\frac{b-a}{a} = \frac{?}{?}$.

X. B. CONTENT: Similar Triangles; Basic Proportionality Theorem

OBJECTIVE: The student will be able to use the Basic Proportionality Theorem to solve related exercises.

ACTIVITIES:

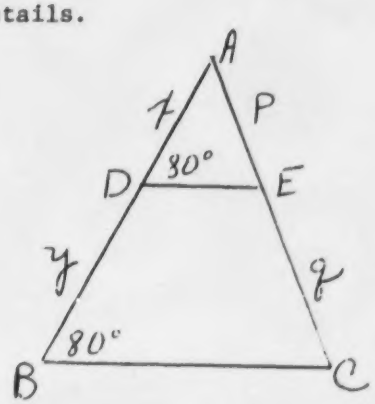
(a) Supply the missing details.

(1) $\frac{x}{p} = \frac{?}{?}$

(2) $\frac{x+y}{y} = \frac{?}{?}$

(3) $\frac{y}{x} = \frac{?}{?}$

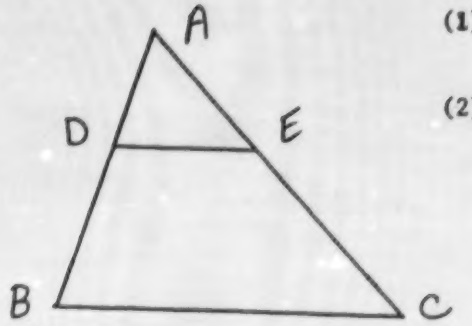
(4) $\frac{q}{y} = \frac{?}{?}$

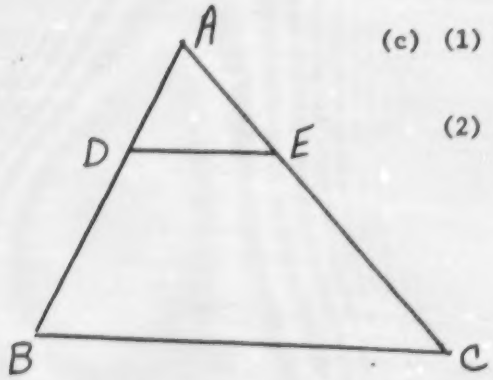


(b) Given $\overline{DE} \parallel \overline{BC}$

(1) If AB = 12, AD = 4 and AE = 3, find AC.

(2) If AD = 3, DB = 2 and AE = 4, find EC.





(c) (1) If $\overline{DE} \parallel \overline{BC}$, AD = 3, AE = 4, AC = 12 and DB = 6, is $\overline{DE} \parallel \overline{BC}$?

(2) If $\overline{DE} \parallel \overline{BC}$, AD = 3, DB = 2, AE = 4, and EC = 3, is $\overline{DE} \parallel \overline{BC}$?

X. C. CONTENT: Similar Triangles; Similarity Theorems

OBJECTIVE: The student will be able to prove that triangles are similar by:

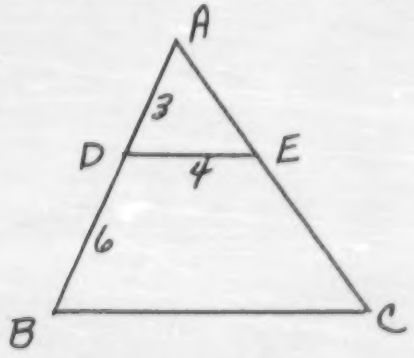
(a) Angle-Angle-Angle;

(b) Side-Angle-Side;

(c) Side-Side-Side.

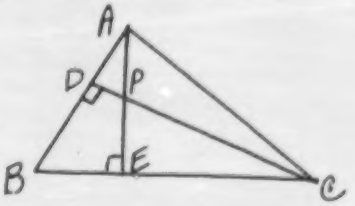
ACTIVITIES:

(a) If $\overline{DE} \parallel \overline{BC}$, find BC.



(b) The lengths of the sides of a triangle are 5, 8 and 12. The lengths of the sides of a second triangle are 6, 2.5 and 4. Are the triangles similar?

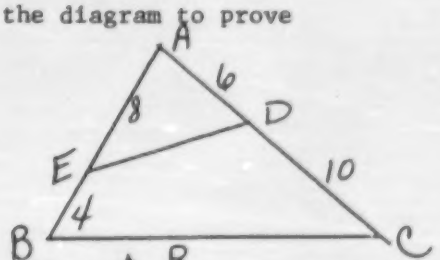
(c) Use the information in the diagram to prove that



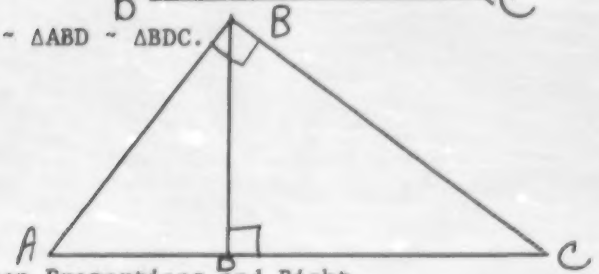
(1) $\Delta ADP \sim \Delta CEP$

(2) $(AE)(DP) = (AD)(EB)$

(d) Use the information in the diagram to prove that $\Delta ADE \sim \Delta ABC$.



(e) Prove that $\Delta ABC \sim \Delta ABD \sim \Delta BDC$.



X. D. CONTENT: Similar Triangles; Mean Proportions and Right Triangles

OBJECTIVE: The student will be able to:

(a) Find the mean proportion between two non-zero numbers;

(b) Use mean proportions to find the lengths of sides of a right triangle.

ACTIVITIES:

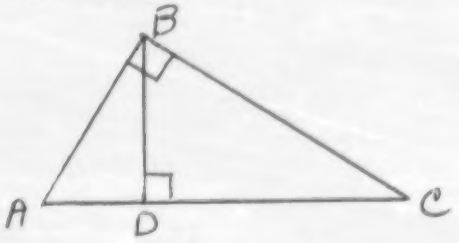
(a) Find the mean proportion between:

(1) 4 and 9

(2) 2 and 16

(3) $\sqrt{2}$ and $\sqrt{6}$

(4) a and b



(b) (1) If AD = 4 and BD = 8, find DC, AB, and BC.

(2) If AB = 6, and AD = 4, find BD, DC, and BC.

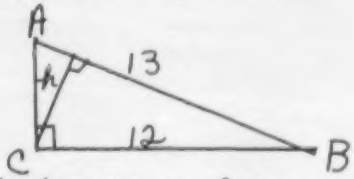
XI. A. CONTENT: Area ; Pythagorean Theorem

OBJECTIVE: The student will be able to use the Pythagorean Theorem and its converse to find the lengths of sides of a right triangle.

ACTIVITIES:

(a) Find the length of a diagonal of a square whose sides have length 10.

(b) Find AC and h.



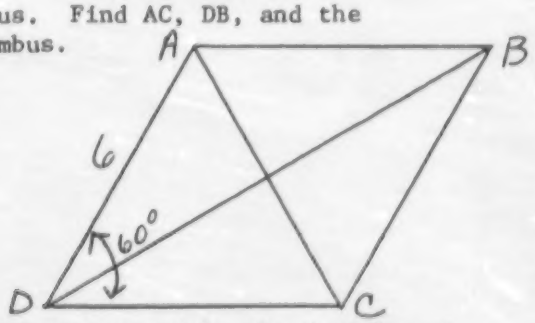
(c)

(1) Find the length of the hypotenuse of a right triangle given that the lengths of the legs are 4 and 8.

(2) Find the length of a leg of a right triangle given that the lengths of the other two sides are 10 and 5.

(d) The diagonals of a rhombus have lengths 8 and 12. Find the length of a side of the rhombus and the length of an altitude to that side.

(e) ABCD is a rhombus. Find AC, DB, and the area of the rhombus.



(f) Which of the following could be the lengths of sides of a right triangle?

(1) 30, 40, 50

(2) 16, 30, 34

(3) 5/3, 8/3, 10/3

XI. B. CONTENT: Area; Special Right Triangles

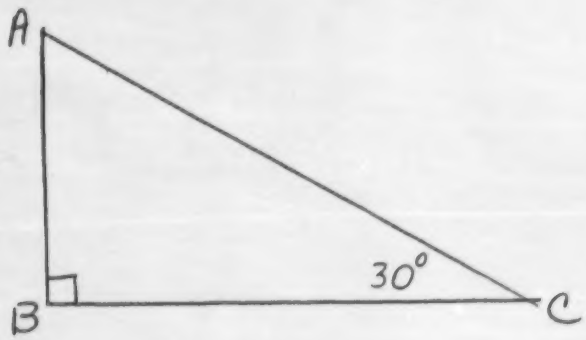
OBJECTIVE: The student will be able to find the lengths of sides of:

(a) a 30-60-90 right triangle;

(b) An isosceles right triangle.

ACTIVITIES:

(a)

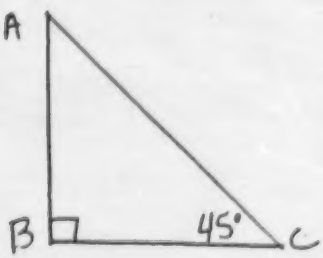


(1) If AB = 4, find AC and BC.

(2) If AC = 12, find AB and BC.

(3) If BC = 6, find AB and AC.

(b)



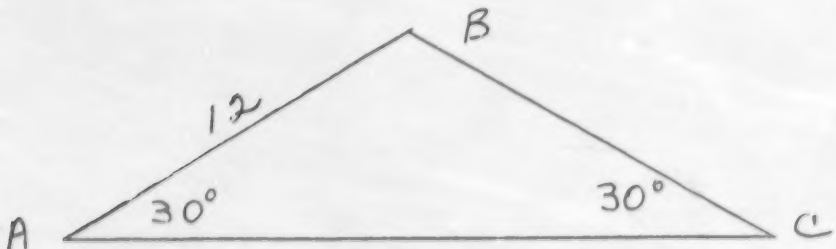
(1) If BC = 6, find AB.

(2) If AB = 12, find AC.

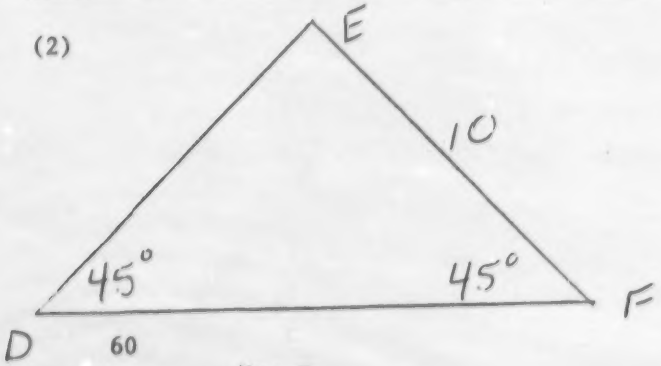
(c) Find the area of an equilateral triangle whose sides have length 6.

(d) Find the area of each triangle.

(1)



(2)



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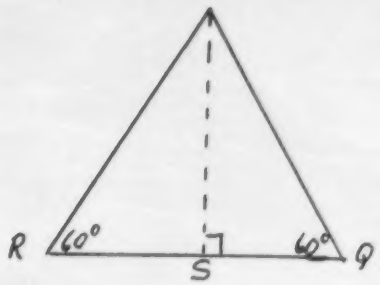
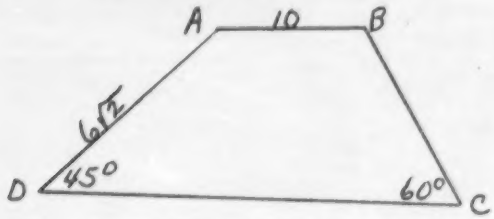


(e) Find the area of the trapezoid.



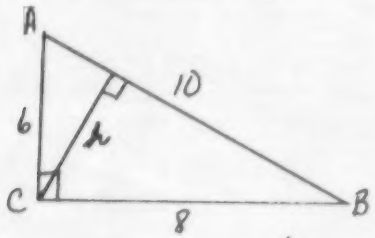
XI. C. CONTENT: Area; Squares; Rectangles; and Triangles

OBJECTIVE: The student will be able to find the area of squares, rectangles and triangles.

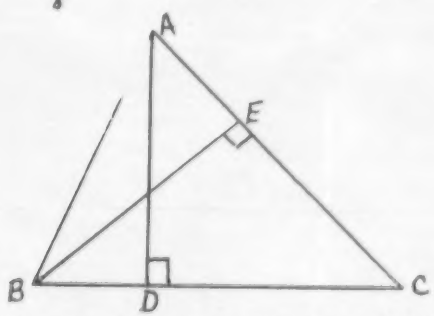
ACTIVITIES:

(a) Find the area of a square whose perimeter is 24.

(b) Find h and the area of ΔABC.



(c)



(1) If AD = 8, BC = 12 and BE = 10, find AC.

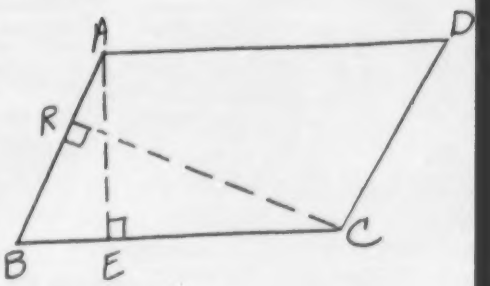
(2) If AC = 18, BE = 6, and AD = 9, find BC.

(d) Prove that a median of a triangle subdivides the triangle into two triangles of equal area.

XI. D. CONTENT: Area; Parallelograms and Trapezoids

OBJECTIVE: The student will be able to find the area of parallelograms and trapezoids.

ACTIVITIES: (a) ABCD is a parallelogram



(1) Find AE if BC = 14

CR = 12 and DC = 7

(2) Find DC if BC = 10

AE = 6, and RC = 8

(b) The formula for the area of a trapezoid is $A = \frac{1}{2}h(b_1 + b_2)$. Find the missing part if you are given that:

(1) h = 10, b_1 = 6, and b_1 = 12

(2) A = 110, h = 10 and b_2 = 8

(c) Prove that the area of a quadrilateral whose diagonals are perpendicular is equal to one-half the product of the lengths of the diagonals.

(d) The diagonals of the rhombus have lengths 12 and 16. Find the length of an altitude if the length of a side is 20.

XI. E. CONTENT: Area; Ratio of Areas

OBJECTIVE: The student will be able to find the ratio of areas and the ratio of length of sides of similar triangles.

ACTIVITIES:

(a) The area of two similar triangles are 16 and 81.

(1) Find the ratio of the lengths of any two corresponding sides.

(2) If the length of one side of the smaller triangle is 4, find the length of the corresponding side of the larger.

(b) The ratio of two corresponding sides of similar triangles is 2/3.

(1) Find the ratio of the areas of the triangle.

(2) If the area of the smaller triangle is 64, find the area of the larger triangle.

XII. A,B. CONTENT: Circles; Terminology ; Chords and Tangents

OBJECTIVES: The student will be able to:

(a) Define and/or identify geometric terms that are associated with circles;

(b) Prove and use theorems that are related to chords and tangents of circles.

ACTIVITIES:

(a) Prove that two chords of a circle are congruent if and only if they are the same distance from the center of the circle.

(b) Prove that the perpendicular bisector of a chord contains the center of the circle.

(c) Prove that a diametral chord (diameter) is the longest chord of a circle.

(d) Prove that the radius drawn to the point of tangency of a tangent line is perpendicular to the tangent line.

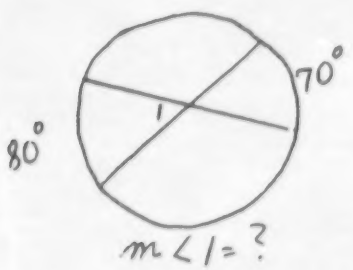
XII. C. CONTENT: Circles; Measurement of Arcs and Angles

OBJECTIVE: The student will be able to use the basic definitions and theorems that are associated with arcs and angles of circles.

ACTIVITIES:

(a) Supply the missing information.

(1)



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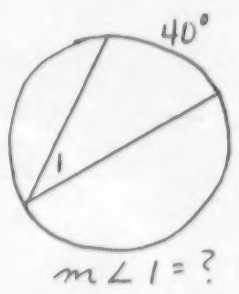

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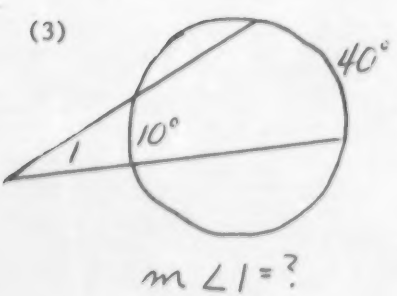
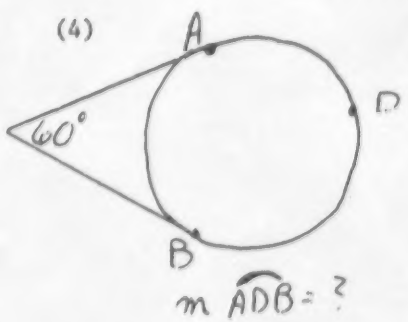


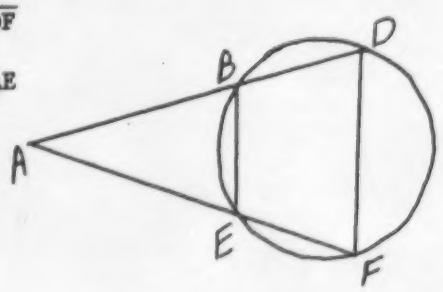
(4)



(b) Prove that the opposite angles of an inscribed quadrilateral are supplementary.

(c) Given: $\overline{BE} \parallel \overline{DF}$

Prove: AB = AE



XII. D. CONTENT: Circles; Common Tangents and Tangent Circles

OBJECTIVE: The student will be able to:

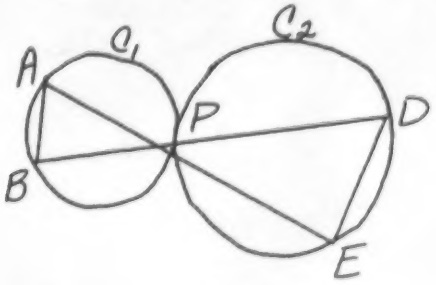
(a) Define and identify common tangents of two circles;

(b) State the conditions under which two circles are tangent;

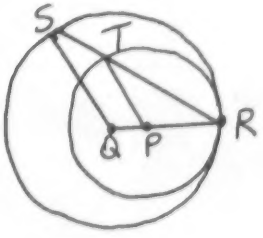
(c) Apply theorems that are associated with common tangents and tangent circles.

ACTIVITIES:

(a) If C_1 and C_2 are tangent at P, prove that $\overline{AB} \parallel \overline{DE}$.



(b) If P and Q are the centers of the tangent circles, prove that $\overline{PT} \parallel \overline{QS}$.



XII. E. CONTENT: Circles; Theorems Concerning Segments

OBJECTIVE: The student will be able to:

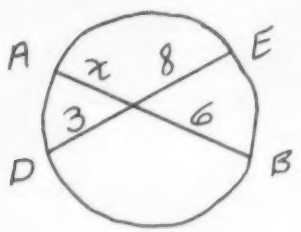
(a) State and apply theorems concerning the lengths of secant segments;

(b) State and apply theorems concerning tangent segments.

ACTIVITIES:

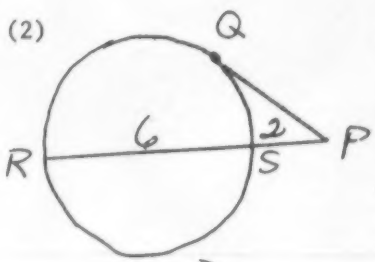
(a) Supply the missing information.

(1)



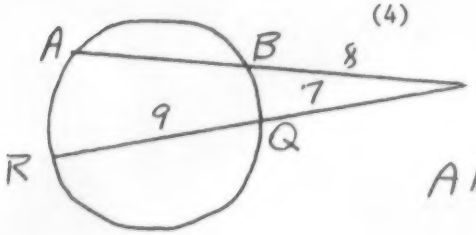
$x = ?$

(2)



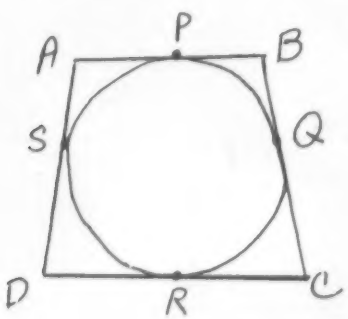
$QP = ?$

(3)



(4) $AB = ?$

(b) Prove that AB + DC = AD + BC



XIII. A. CONTENT: Constructions; Concurrency Theorems

OBJECTIVE: The student will be able to state and use the concurrency theorems concerning:

(a) Angle bisectors of a triangle;

(b) Perpendicular bisectors of the sides of a triangle;

(c) Altitudes of a triangle;

(d) Medians of a triangle.

ACTIVITIES:

(a) Prove that if the point of concurrency of the perpendicular bisectors of the sides of a triangle is on the triangle, then the triangle is a right triangle.

(b) For what kind of triangle (scalene, isosceles, equilateral) is it true that the four points of concurrency (angle bisectors, medians, etc.) are:

(1) The same point?

(2) Four collinear points?

(3) Four noncollinear points?

XIII. B CONTENT: Constructions; Basic Constructions

OBJECTIVE: The student will be able to use a straight edge and compass to:

(a) Copy a segment of an angle;

(b) Bisect an angle and a segment;

(c) Construct lines perpendicular to a given line;

(d) Construct lines parallel to a given line;

(e) Copy triangles;

(f) Subdivide a segment into two or more congruent parts;

(g) Inscribe triangles in circles and circles in triangles;

(h) Circumscribe circles about triangles and triangles about circles;

(i) Construct tangents to circles.

ACTIVITIES:

(a) Copy a triangle using SAS.

(b) Subdivide a segment into 5 congruent parts.

(c) Construct a triangle and inscribe a circle in it. Circumscribe a circle about the triangle.

(d) Construct a line parallel to a line from a given point.

XIII. C. CONTENT: Construction; Applications

OBJECTIVE: The student will be able to use the basic constructions to construct figures satisfying given conditions.

ACTIVITIES:

(a) Construct a 30-60-90 right triangle.

(b) Circumscribe an equilateral triangle about a given circle.

(c) Construct a rhombus given two segments whose lengths are the lengths of the diagonals of the rhombus.

(d) Draw any segment $\overline{AB}$. Construct an equilateral triangle so that an altitude of the triangle has length AB.

(e) Construct a circle. Select any point P in the exterior of the circle and construct the two tangent lines to the circle from P.

XIV. A. CONTENT: Circular and Polygonal Regions; Polygons

OBJECTIVE: The student will be able to:

(a) Define polygon;

(b) Find the sum of the measures of the angles of an n-gon;

(c) Determine the number of diagonals in any n-gon;

(d) Find the sum of the measures of the exterior angles of any polygon.

ACTIVITIES:

(a) Find the sum of the measures of the angles of:

(1) An octagon.

(2) A pentagon.

(3) A 20-gon.

(b) Find the number of sides of the polygon, given that the sum of the measures of its angles is:

(1) 900.

(2) 1,800.

(3) 1,260.

(c) Find the number of diagonals in:

(1) A pentagon.

(2) A decagon.

(3) An 18-gon.

(d) Find the sum of the measures of the exterior angles of a hexagon.

XIV. B. CONTENT: Circular and Polygonal Regions; Regular Polygons

OBJECTIVE: The student will be able to:

(a) Define a regular polygon;

(b) Find the degree measure of any angle of a regular n-gon;

(c) Find the area of the region bounded by selected regular polygons.

ACTIVITIES:

(a) Find the measure of each angle of a regular:

(1) 5-gon.

(2) 9-gon.

(3) 18-gon.

(b) Find the number of sides of the regular polygon given that the measure of each angle is:

(1) 150.

(2) 165.

(3) 135.

(c) If the length of a side of a regular hexagon is 12, find the area of the hexagon.

XIV. C. CONTENT: Circular and Polygonal Regions; Circles

OBJECTIVE: The student will be able to:

(a) Find the circumference of a circle;

(b) Find the area of a circular region.

ACTIVITIES:

(a) Find the circumference of a circle whose radius is 8.

(b) The diameter of a circle is 10. Find the area of the circle.

(c) Find the area of a circle whose circumference is 12π.

(d) The diameter of a washer is 12 and the diameter of the hole in the washer is 8. Find the area of the washer.

(e) A circle is circumscribed about an equilateral triangle. If the length of a side of the triangle is 6, find the diameter, the circumference and the area of the circle.

XIV. D. **CONTENT:** Circular and Polygonal Regions, Sectors and Arcs

OBJECTIVE: The student will be able to:

(a) Find the area of sectors of circular regions.

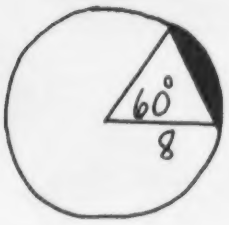
(b) Find the lengths of arcs of circles.

ACTIVITIES:

(a) If the diameter of a circle is 12, find the length of a 120 degree arc of the circle.

(b) If the radius of a circle is 18, find the area of a sector that has a 60 degree arc.

(c) Find the area of the shaded region.



XV. A CONTENT: Volume

OBJECTIVE: The student will be able to identify a prism, a pyramid, a cone, a cylinder and a sphere.

ACTIVITIES:

(a) Identify each of the following figures:

(1) Prism.

(2) Pyramid.

(3) Cone.

(4) Cylinder.

(5) Sphere.

XV. B CONTENT: Volume

OBJECTIVE: The student will be able to define lateral area, total area and volume.

ACTIVITIES:

(a) Define the following:

(1) Lateral area.

(2) Total area.

(3) Volume.

XV. C. CONTENT: Volume, Prism, Pyramid, Cone, Cylinder, Sphere

OBJECTIVE: The student will be able to find lateral area, total area, and volume of these figures.

ACTIVITIES:

(a) Find lateral area, total area and volume of each of the following:

(1) A rectangular solid 6cm x 8cm x 10cm.

(2) A pyramid with a regular hexagonal base with side 4cm and height 8cm.

(3) A cylinder with radius of 6cm and height of 12cm.

(4) A cone with the same dimensions.

(5) A sphere whose diameter is 15cm.

XVI. A,B. CONTENT: Coordinate Geometry, Definition, Slope of Segments and Lines

OBJECTIVE: The student will be able to:

(a) Define and/or identify terms associated with a two-dimensional coordinate system;

(b) Find the slope of segments and lines.

ACTIVITIES:

(a) Find the slope of the segment whose endpoints have the following coordinates.

(1) (2,4) and (6,8).

(2) (-1,2) and (-3,-4).

(3) (-4,1) and (-4,2).

(4) (2,3) and (6,3).

(5) (-2,-6) and (-4,6).

(b) The vertices of a quadrilateral are P(5,-2) Q(-4,2), R(4,6) and S(3,2). Prove that the quadrilateral is a parallelogram.

(c) Find x or y so that the line containing $\overline{PQ}$ has slope m.

(1) P(4,-2), Q(6,y); m = 5.

(2) P(x,-3), Q(-5,3); m = -6.

XVI. C. CONTENT: Coordinate Geometry, Distance and Midpoint Formulas

OBJECTIVE: The student will be able to:

(a) Find the distance between two points;

(b) Find the coordinates of the midpoint of a segment given the coordinates of its endpoints.

ACTIVITIES:

(a) Find the distance between the points whose coordinates are:

(1) (5,1) and (5,11).

(2) (-3,-8) and (2,4).

(3) (1,1) and (7,5).

(4) (a,b) and (-a,b).

(b) Find the coordinates of the midpoint of $\overline{PQ}$ if:

(1) P(-2,4) and (Q(4,8).

(2) P(3,-4) and Q(5,-2).

(3) P(a,b) and Q(c,d).

(c) (1) Prove that A(2,-2), B(-1,1) and C(-5,5) are collinear.

(2) Find the perimeter of a triangle whose vertices are (P(6,-3), Q(4,-2), and R(-6,-9).

(3) Show that the triangle whose vertices are P(-7,1), Q(1,-3) and R(6,7) is a right triangle.

(4) The vertices of a quadrilateral are P(2,-9) Q(10,5), R(6,-2) and S(2,-4). Prove that the quadrilateral is an isosceles trapezoid.

(5) The coordinates of A, B and C are (4,3) (-6,6) and (-2,5) respectively. Prove that the segment whose endpoints are the midpoints of $\overline{AB}$ and $\overline{AC}$ is parallel to $\overline{BC}$ and half as long.

XVI. D. CONTENT: Coordinate Geometry, Equations and Lines

OBJECTIVE: The student will be able to write an equation of a line given:

(a) The slope of the line and its y-intercept;

(b) The coordinates of two points on the line;

(c) The coordinates of a point on the line and the slope of the line.

ACTIVITIES:

(a) Write an equation of the line given that m and b are the slope and y-intercept respectively.

(1) $m = 3$; $b = 2$.

(2) $m = \frac{2}{3}$; $b = 5$

(3) $m = 0$; $b = -4$.

(b) Write an equation of $\overleftrightarrow{PQ}$ given that:

(1) P(5,2) and Q(-3,5).

(2) P(,-1) and Q(7,-2).

(3) P(-3,2) and Q(5,-4).

(c) Write an equation of the line that contains P and has slope m.

(1) P(-2,3); m = 4.

(2) P(3,-1); $m = -\frac{2}{3}$.

(3) (-2,4); m = -2.

(d) The coordinates of A, B and C are A(2,3), B(-4,6) and C(-8,4).

(1) Write an equation of $\overleftrightarrow{AB}$.

(2) Find an equation of the median form B.

XVI. E. CONTENT: Coordinate Geometry, Equations of Parallel and Perpendicular Lines

OBJECTIVE: The student will be able to:

(a) Find an equation of a line parallel to a given line;

(b) Find an equation of a line perpendicular to a given line.

ACTIVITIES:

(a) Find an equation of the line that contains P(-1,2) and is parallel to the line that contains Q(-3,1) and R(-2,-3).

(b) Find an equation of the line that contains P(-2,1) and is parallel to the graph of 2x - 3y = 6.

(c) Find an equation of the line that contains P(2,1) and is perpendicular to the graph of x - 2y = 6.

XVI. F. CONTENT: Coordinate Geometry, Graphs

OBJECTIVE: The student will be able to graph a line given:

(a) The slope of the line and its y-intercept;

(b) A point on the line and its slope;

(c) An equation of the line.

ACTIVITIES:

(a) Graph the line that has the indicated slope and y-intercept.

(1) $m = 2$; $b = 3$.

(2) $m = -\frac{2}{3}$; $b = -2$.

(3) $m = 0$; $b = -4$.

(b) Graph the line that contains the given point and has slope m.

(1) $P(2,-3)$; $m = 3$.

(2) $P(-2,-4)$; $m = -\frac{3}{5}$.

(3) $P(-4,0)$; $m = 0$.

(c) Sketch the graph of each equation.

(1) $y = 2x + 4$.

(2) $y - 2x + 6$.

(3) $y - 2x = 0$.

(4) $3x - 2y = 6$.

(5) $y - 4 = 2(x - 3)$.

XVI. G. CONTENT: Coordinate Geometry, Proofs by Coordinate Methods

OBJECTIVE: The student will be able to prove theorems by coordinate methods.

ACTIVITIES:

Use coordinate methods to prove the following:

(a) The diagonals of a parallelogram bisect each other.

(b) The diagonals of a rhombus are perpendicular.

(c) If the diagonals of a parallelogram are perpendicular, then the parallelogram is a rhombus.

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